The balance before and after dehydration: an experiment to see the difference

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Authors' contribution:
A. Conception and design of the study; B. Acquisition of data; C. Analysis and interpretation of data; D. Manuscript preparation; E. Obtaining funding


Abstract

Background and Study Aim. Balance is the ability to maintain the position of the body when standing, doing activities, also useful equilibrium, posture in order to be able to perform movement activities properly. water is very important for humans which is useful for maintaining cell hemostasis, fluid management interventions that pay attention to intake and output records that te Physical activity is a movement that involves muscles and energy working harder. This study aims to determine the difference in the effect before and after dehydration on body balance.

Material and Methods. This research is a descriptive experiment. This research was conducted at the Sultan Syarif Abdurahman stadium field, Pontianak City. The population used Sports Coaching Education students. Purposive sampling technique so that 16 students were sampled. The treatment was in the form of running 400m x 5 with a percentage of dehydration of 2%. Furthermore, the data were analyzed using SPSS 26.

Results. The results showed a significance value of 0.241> 0.05, it can be concluded that there is no significant difference before and after dehydration on body balance. However, the calculation results can be seen that the mean balance will decrease if the body is dehydrated.

Conclusions. Although there is a variation in the mean value, the difference does not reach the level of statistical significance. Thus, it can be concluded that body balance is not significantly affected by fluid loss before and after dehydration.

Introduction

The term "body" encompasses the entirety of an individual's physical structure, comprising organs, bones, muscles, skin, and other components. It serves as a tool for engaging in various daily activities (Khotimah et al., 2021). The body is a complex system of interconnected organs and
systems collaborating to sustain life and health. It consists of diverse systems, including the respiratory, digestive, circulatory, nervous, endocrine, reproductive, and more, each performing distinct functions to uphold bodily equilibrium. These functions involve essential processes like digestion, temperature regulation, immune maintenance, and others (Hidayat & Syahputra, 2020; Rasyid, 2021).

The human body, equipped with muscles and skeletons, facilitates movement and supports good posture through regular exercise, sufficient rest, and a balanced diet. Engaging in physical or mental activities aimed at preserving and enhancing body health qualifies as sports or exercise (Ramadhan & Bulqini, 2018; Rasyid, 2021). Physical activity entails muscle involvement and heightened energy expenditure (Leonardo & Komaini, 2021; Saputro & Juntara, 2022). Muscles, as active tissue, contribute to bodily movement (Putri et al., 2020). Sports demand stable physical fitness to ensure overall well-being (Lloret et al., 2023).

An active body, when not replenished with adequate water to compensate for fluid loss, is susceptible to dehydration (Niyalatul Muna et al., 2020). Dehydration occurs when the body loses a substantial amount of fluids, leading to significant physiological changes (Perdana et al., 2022; Saputro & Juntara, 2022). High temperatures, exceeding 45 degrees Celsius, exacerbate the risk of dehydration, evident in the color of urine (Wang et al., 2023). Maintaining balance during exercise refers to the body's capacity to sustain a specific position or execute controlled movements. Balance training may involve activities such as one-legged standing, dynamic movements with stability, or utilizing aids like balance balls or boards (Rasyid, 2021; Zemková, 2014).

Balance involves managing the caloric intake and expenditure within the body. Maintaining energy balance occurs when the calories consumed align with those burned through physical activity. An energy imbalance, where more calories are consumed than expended, can result in weight gain. Postural balance and movement coordination pertain to the body's capability to sustain a stable position and execute movements with proper coordination (Kemenkes, 2021; Rasyid, 2021). Exercises targeting these aspects enhance core muscle strength, promote joint stability, and refine overall body coordination.

Enhancing balance in sports offers advantages such as optimizing proficiency in technical movements, preventing falls or injuries, and enhancing performance in specific sports (Rasyid, 2021; Rimasa & Sartono, 2020). Recent advancements in research have shed light on the impact of dehydration on body balance, primarily by comparing conditions before and after dehydration. These studies explore various facets, from neuromuscular responses to alterations in postural strategies, contributing to a deeper comprehension of body balance within the context of modified hydration status. Consequently, this study sought to discern disparities in the effects of pre- and post-dehydration on body balance.

**Materials and Methods**

**Participants.**

This study was conducted at the Sultan Syarif Abdurrahman stadium field, involving students from the Sports Coaching Education Study Program. The sampling method employed was purposive sampling, resulting in a sample size of 16 students, comprising 12 males and 4 females, with an average age range of 19-20 years.

**Research Design.**

The research adopted an experimental approach. Initially, participants underwent digital body weight measurements to assess hydration status by monitoring changes in body weight. Dehydration, equivalent to 2% of body weight loss, was then determined. Prior to dehydration, participants underwent a balance test involving closing their eyes, placing hands on their waists, and lifting one leg, measuring the duration they could maintain an upright stance. Subsequently, the treatment involved five 400m runs. After experiencing 2% dehydration, participants underwent a final test,
involving body weight measurements. If the predetermined body weight was not attained, participants underwent sunbathing with a raincoat, lasting 2-5 minutes, until the target body weight was achieved.

**Statistical analysis.**

Descriptive analysis was employed to interpret the data obtained, utilizing the SPSS version 26 application. The statistical analysis encompassed a normality test and hypothesis testing.

**Results**

This research was conducted on May 7, 2023 and was conducted in the morning at the Sultan Syarif Abdurahman stadium field. The dehydration process is done by jogging 400x5 on the running track. The calculation results can be seen that the average balance will decrease if the body is dehydrated, which before dehydration has an average balance of 22.25 seconds and after dehydration the balance drops to 18.27 seconds. The results can be seen in table 1 and figure 1.

**Table 1. Description of Balance Results Before and After Dehydration**

<table>
<thead>
<tr>
<th>Result</th>
<th>Before Dehydration</th>
<th>After Dehydration</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Mean</td>
<td>22.25</td>
<td>18.27</td>
</tr>
<tr>
<td>Median</td>
<td>246.400</td>
<td>172.600</td>
</tr>
<tr>
<td>Mode</td>
<td>29.72</td>
<td>11.34</td>
</tr>
</tbody>
</table>

**Figure 1. Before and After Dehydration**

However, if the data is considered significant when calculated at (p > 0.05). Can be concluded normal. If the data is normal, parametric tests can be carried out. Parametric tests are carried out with independent tests. The results are seen in table 2.

Based on the results of the difference test, the significance value is 0.241 > 0.05, which means there is no significant difference. These results provide information that before dehydration and after dehydration do not provide significant differences in body balance. The results can be seen in table 3.

**Table 2. Uji normality in the One-Sample Kolmogorov-Smirnov Test**

<table>
<thead>
<tr>
<th>Result</th>
<th>Before dehydration</th>
<th>After dehydration</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Normal Parameters(^{a,b}) Mean</td>
<td>222.581</td>
<td>182.719</td>
</tr>
</tbody>
</table>
Table 3. Independent Sample Test Before and After Dihedration

<table>
<thead>
<tr>
<th>Balance</th>
<th>Result</th>
<th>F</th>
<th>Mean</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before and After</td>
<td>Equal variances</td>
<td>.089</td>
<td>.767</td>
<td>1.195</td>
<td>30</td>
<td>.241</td>
</tr>
<tr>
<td>Dehydration</td>
<td>Equal variances</td>
<td>not assumed</td>
<td>1.195</td>
<td>29.995</td>
<td>.241</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

This research aims to assess the impact of dehydration on body balance and explore potential differences before and after dehydration. The findings indicate no significant difference in body balance pre- and post-dehydration. However, the mean balance value before dehydration (22.25) is higher than after dehydration (18.27), showing a difference of 3.98 seconds. In contrast, prior studies on dehydration during running activities yielded significant differences before and after dehydration (Hidayatulloh & Gandasari, 2023).

Water, a vital nutrient for the body, influences the composition of muscle and adipose tissue due to varying water content (Nurfrida & Lestari, 2023). Dehydration, characterized by the loss of solutes and water, can disrupt the body's thermoregulation and cardiovascular functions (Sannolo & Carretero, 2019). The consequences of dehydration include health risks and an increased workload on the body. Dehydrated individuals may experience elevated body temperature, reduced reaction speed, and concentration due to inhibited energy production (Ramdhan & Rismayanthi, 2016). Fluid intake plays a crucial role in dissolving compounds, regulating body temperature, lubricating joints, serving as a means of transportation, and maintaining normal cell structures and functions (Habibati et al., 2022).

Dehydration is often overlooked, as its effects may not be immediately apparent or significant. It occurs when fluid intake is insufficient compared to fluid loss (Leksana, 2015; Sari Maslicha & Anang S.B, 2017). Hence, early detection techniques for body dehydration are essential to prevent more severe health issues (Wahiddin, 2020). Recognizing the importance of hydration, especially for athletes, is crucial for optimal performance, as a decrease in body fluid levels can compromise endurance capacity during exercise (Fen Tih et al., 2017).

Water is a critical component for maintaining cellular homeostasis in the human body (Maryanto, 2020). Effective strategies to address dehydration involve implementing fluid management interventions with careful monitoring of intake and output records (Muhammad et al., 2020). Ensuring adequate fluid administration throughout training and competitions plays a vital role in preserving hydration status (Haetami et al., 2022). Dehydration can adversely impact cardiovascular performance and disrupt the regulation of body thermoregulation (Kusuma, 2020). Electrolytes are instrumental in maintaining fluid balance, and a deficiency in electrolytes can contribute to dehydration (Nahdlotul Halimi et al., 2019).

The concept of balance holds immense importance, encompassing physical elements crucial for both sports and daily activities (Indrawathi, 2017). It entails the ability to sustain a stable body position while standing (Munawarah, 2019). The capacity to maintain balance is vital for various activities, contributing to the maintenance of gravitational position, particularly when standing upright (Afafah, 2018). Balance plays a key role in preserving posture and facilitating proper movement activities (Raharjo et al., 2020). Static balance, specifically, refers to the ability to sustain
a balanced state while the body is at rest (D’Antonio et al., 2020), ensuring that the body position remains unchanged (Kartiyani et al., 2016).

Unfortunately, there is often a lack of awareness regarding this understanding, leading to the common mistake of only drinking water when thirsty. This habit can result in an imbalanced fluid circulation and regeneration due to insufficient comprehension of the nutritional levels required by bodily fluids (Kusumawardani & Larasati, 2020)

Conclusion

Conclusion from this study states that before and after dehydration on balance showed no significant difference. Although there were variations in the mean values, the differences did not reach the level of statistical significance. Therefore, it can be concluded that body balance is not significantly affected by fluid loss before and after dehydration. These results provide different information to previous studies related to fluid deprivation. However, it should also be understood that this study did not look at other factors such as the health condition of the sample and other factors that might affect the results of the study. Recommendations for further research can add other variables that are factors that affect the balance of fluid loss.

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Conflict of Interest And Funding

There is no conflict of interest.

References


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